Tech
B

No. 66—1914.

British Engineering Standards Association.

(Incorporated 1918.)

FORMED IN 1901 AS THE ENGINEERING STANDARDS COMMITTEE
BY
THE INSTITUTION OF CIVIL ENGINEERS.
THE INSTITUTION OF MECHANICAL ENGINEERS.
THE INSTITUTION OF NAVAL ARCHITECTS.
THE IRON AND STEEL INSTITUTE.
THE INSTITUTION OF ELECTRICAL ENGINEERS.

UNIVERSITY OF TORONTO
MAY 19 1920
LIBRARY

BRITISH
STANDARD SPECIFICATION
FOR
COPPER-ALLOY
THREE-PIECE UNIONS
FOR
LOW AND MEDIUM PRESSURE
BRITISH STANDARD SCREWED COPPER TUBES
(PRIMARILY FOR DOMESTIC AND SIMILAR WORK).

LONDON
PUBLISHED FOR THE ASSOCIATION BY CROSBY LOCKWOOD & SON,
7, STATIONERS' HALL COURT, LUDGATE HILL, E.C. 4; AND 5, BROADWAY, LONDON, S.W. 1,
AND TO BE PURCHASED FROM ANY BOOKSELLER, OR DIRECT FROM THE OFFICES OF THE ASSOCIATION,
28, VICTORIA STREET, LONDON, S.W. 1.

May, 1919.

COPYRIGHT. ALL RIGHTS RESERVED.

Price 1/- Net. Post Free 1/2.

No. 66—1914.

British Engineering Standards Association.

(Incorporated 1918.)

FORMED IN 1901 AS THE ENGINEERING STANDARDS COMMITTEE
BY
THE INSTITUTION OF CIVIL ENGINEERS.
THE INSTITUTION OF MECHANICAL ENGINEERS.
THE INSTITUTION OF NAVAL ARCHITECTS.
THE IRON AND STEEL INSTITUTE.
THE INSTITUTION OF ELECTRICAL ENGINEERS.

BRITISH STANDARD SPECIFICATION FOR COPPER-ALLOY THREE-PIECE UNIONS FOR LOW AND MEDIUM PRESSURE BRITISH STANDARD SCREWED COPPER TUBES

(PRIMARILY FOR DOMESTIC AND SIMILAR WORK).

LONDON:
PUBLISHED FOR THE ASSOCIATION BY CROSBY LOCKWOOD & SON,
7, STATIONERS' HALL COURT, LUDGATE HILL, E.C. 4; AND 5, BROADWAY, LONDON, S.W. 1,
AND TO BE PURCHASED FROM ANY BOOKSELLER, OR DIRECT FROM THE OFFICES OF THE ASSOCIATION,
28, VICTORIA STREET, LONDON, S.W. 1.

May, 1919.

COPYRIGHT. ALL RIGHTS RESERVED.

Price 1/- Net. Post Free 1/2.

CONTENTS.

PAGE.

List of Members of Main Committee 3
List of Members of Sectional Committee on Screw Threads and Limit Gauges 4
List of Members of Sub-Committee on Metal Tubes and Connections 4
Preface 5

SPECIFICATION: TABLE OF CLAUSES.

1. Standard Designation of Unions 7
2. Nomenclature of Component Parts 7
3. General Dimensions 8
4. Form of Ends and Nut 8
5. Screw Threads 8
6. Material 8
7. Analysis 9
8. Mechanical Tests 9
9. Tensile Test Pieces 9
10. Tensile Test 9
11. Additional Tensile Test before Rejection 9
12. Hydraulic Test 10
13. Gauging 10
14. Inspection and Rejection 10
15. Testing Facilities and Place of Testing 11
16. Arbitration 11

TABLES.

Table I. Liner 15
Table II. Male Screw Piece 17
Table III. Nut 19

APPENDICES.

Appendix I. Notes on Tables 22
Appendix II. Definitions relating to Screw Threads ... 23
Appendix III. Forms of British Standard Tensile Test Pieces 25

BRITISH ENGINEERING STANDARDS ASSOCIATION.

MAIN COMMITTEE.

† SIR ARCHIBALD DENNY, BART. (*Chairman*).

SIR MAURICE FITZMAURICE, C.M.G. (*Vice-Chairman*).

SIR ROBERT ELLIOTT-COOPER, K.C.B. ...	Nominated by the Institution of Civil Engineers.
SIR WILLIAM MATTHEWS, K.C.M.G. ...	
SIR DOUGLAS FOX...	
MR. ALEXANDER ROSS	
DR. W. C. UNWIN	
MR. H. A. IVATT	Nominated by the Institution of Mechanical Engineers.
MR. MICHAEL LONGRIDGE	
DR. WILLIAM H. MAW	
MR. G. AINSWORTH	Nominated by the Iron and Steel Institute.
DR. ARTHUR COOPER	
MR. ILLTYD WILLIAMS	
SIR THOMAS BELL, K.B.E.	Nominated by the Institution of Naval Architects.
SIR WILLIAM SMITH, C.B.	
SIR JOHN SNELL	Nominated by the Institution of Electrical Engineers.
COL. R. E. CROMPTON, C.B.	
MR. C. P. SPARKS...	
MR. F. R. DAVENPORT	Co-opted by the Nominated Members to represent the Federation of British Industries.
MR. F. W. GILBERTSON	
HON. SIR CHARLES PARSONS, K.C.B. ...	Co-opted by the Nominated Members.
SIR ROBERT HADFIELD, BART.	
SIR RICHARD GLAZEBROOK, C.B. ...	

DR. J. H. T. TUDSBERY (*Hon. Secretary*).

MR. C. LE MAISTRE (*Secretary*).

MR. CHARLES DRESSER (*Assistant Secretary*).

† Succeeded the late SIR JOHN WOLFE BARRY, K.C.B., February, 1918.

BRITISH ENGINEERING STANDARDS ASSOCIATION.

The following are lists of Members of the Sectional Committee on Screw Threads and Limit Gauges, and of the Sub-Committee on Metal Tubes and Connections.

SECTIONAL COMMITTEE ON SCREW THREADS AND LIMIT GAUGES.

August, 1914.

Chairman, †SIR H. FREDERICK DONALDSON, K.C.B.
Admiralty, Eng.-Rear-Admi. E. F. Ellis, R.N.
War Office, Mr. G. H. Roberts.
Board of Trade, Major P. A. MacMahon, R.A. (Ret.).
Crown Agents for the Colonies, Mr. Ashton M. Heath.
National Physical Laboratory, Dr. R. T. Glazebrook, C.B.
Institution of Mechanical Engineers, Mr. Michael Longridge; Mr. R. Matthews.
Institution of Naval Architects, Mr. C. H. Wingfield.
Institution of Gas Engineers, Mr. Alexander Wilson.
Institution of Automobile Engineers, Mr. A. Sharp.
Institute of Marine Engineers, Mr. D. Hulme; Mr. F. E. Pratten.
Locomotive Manufacturers' Parliamentary Association, Mr. Hugh Reid; Mr. W. Collingwood.
Association of Railway Locomotive Engineers, Mr. H. N. Gresley; Mr. Henry Fowler.
British Tube Association, Mr. A. W. Hutton; Mr. J. G. Stewart.
Brass and Copper Tube Association, Mr. W. W. Gibbins.
*Sir William Preece, K.C.B.; Col. R. E. B. Crompton, C.B.; Col. H. C. L. Holden, C.B., R.A. (ret.); Mr. H. I. Brackenbury (*Sir W. G. Armstrong, Whitworth & Co., Ltd.*); Mr. L. S. Crawshaw (*The Automatic Standard Screw Co.*); Mr. R. D. T. Heap; Mr. William Reavell (*Reavell & Co., Ltd.*); Mr. C. Salmon, Inspector of Machinery, R.N. (ret.) (*Vickers Ltd.*); Mr. W. Taylor (*Taylor, Taylor & Hobson, Ltd.*).

* Deceased, November, 1913.
† Since deceased.

SUB-COMMITTEE ON METAL TUBES AND CONNECTIONS.

August, 1914.

Chairman, COL. H. C. L. HOLDEN, C.B., R.A. (Ret.).
Institution of Heating and Ventilating Engineers, Mr. Chas. R. Honiball.
National Association of Master Heating and Domestic Engineers, Mr. W. L. White.
**Joint Committee on Screwed Copper Pipe Standards*, Mr. W. Nelson Haden.
Brass and Copper Tube Association, Mr. W. W. Gibbins.
Society of Motor Manufacturers and Traders, Mr. G. A. Burls.
Col. R. E. B. Crompton, C.B.; Mr. J. H. Clements (*Clements, Jeakes & Co.*); Mr. H. N. Gresley (*Great Northern Railway Co.*); Mr. H. L. Reason (*John Russell & Co., Ltd.*); Mr. O. M. Row (*Royles Ltd.*); Mr. Frederick Tomlinson (*The Broughton Copper Co., Ltd.*)

* Appointed by the Institution of Heating and Ventilating Engineers and the National Association of Master Heating and Domestic Engineers.

PREFACE.

The Sectional Committee on Screw Threads and Limit Gauges was appointed by the Main Committee on February 13th, 1903. The Sub-Committee on Metal Tubes and Connections was appointed by the Sectional Committee at their meeting on March 26th, 1912, the appointment being confirmed by the Main Committee on July 18th, 1912.

The Standardisation of Copper-Alloy Three-Piece Unions for Screwed Copper Tubes was first considered by the Sub-Committee when dealing with the Standardisation of Screwed Copper Tubes. A considerable amount of information as to general practice had previously been obtained by the Sectional Committee on Screw Threads and Limit Gauges and the Sub-Committee on Automobile Threads but the consideration of Standard Unions for use in connection with Screwed Copper Tubes was not, however, commenced until March, 1912, when the matter was taken up at the request of a Joint Committee appointed by the Institution of Heating and Ventilating Engineers and the National Association of Master Heating and Domestic Engineers.

The Unions dealt with in this Report are designed to withstand steam pressures up to 125 lbs. per square inch and are intended for use with two of the Tables (viz., Tables I and II, Low and Medium Pressure Tubes) in the British Standard Specification for Screwed Copper Tubes and their Screw Threads (primarily for domestic and similar work), Report No. 61. The Unions are so designed that the same Union can be used for Tubes of the same nominal size in either of the above Tables.

The Sub-Committee desire to record the assistance given them by the above named Joint Committee and the pioneer work undertaken on their behalf by Mr. H. L. Reason. They also desire to record their high appreciation of the valuable services rendered by their late Chairman, Mr. Henry Lea, whose death on July 20th, 1912, in the midst of their deliberations, deprived the Sub-Committee of the intimate knowledge possessed by him of the various points under consideration.

This report was adopted by the Sectional Committee on Screw Threads and Limit Gauges on May 25th, 1914.

This report was approved by the Main Committee at their meeting held on July 16th, 1914.

Note.—*The Association desires to call attention to the fact that this Specification is intended to include the technical provisions necessary for the supply of the material herein referred to but does not purport to include all the necessary provisions of a Contract.*

BRITISH STANDARD SPECIFICATION FOR COPPER-ALLOY THREE-PIECE UNIONS FOR LOW AND MEDIUM PRESSURE BRITISH STANDARD SCREWED COPPER TUBES (PRIMARILY FOR DOMESTIC AND SIMILAR WORK).

Standard Designation of Unions.

1. The Committee recommend that all Unions made in accordance with the requirements of this Specification be known as :—

British Standard Copper-Alloy Three-Piece Unions for British Standard Low and Medium Pressure Screwed Copper Tubes (primarily for Domestic and Similar Work).

Nomenclature of Component Parts.

2.—The three component parts of the Union shall be known :—

Liner.—The piece which is screwed internally at one end to receive the pipe and has a spherical shaped nipple at the other end. (*See* Figs. 4 and 5.)

Male Screw Piece.—The piece which is screwed internally at one end to receive the pipe, and has a spherical shaped seat to receive the nipple at the other end which also carries the male coupling thread. (*See* Figs. 6 and 7).

Nut.—The piece of largest diameter containing the female coupling thread. (*See* Figs. 8 and 9).

Two examples of assembled British Standard Copper-Alloy Three-Piece Unions are shown in Figs. 2 and 3, page 12.

General Dimensions.

3. All Three-Piece Unions purporting to be made to the British Standard shall have the dimensions specified for the various elements in Tables I, II, and III.

Form of Ends and Nut.

4. The end of the Liner, the end of the Male Screw Piece, and the Nut of the Union shall be hexagonal in form for nominal sizes up to and including $\frac{3}{8}$ in., and octagonal for nominal sizes $\frac{1}{2}$ in. and above. They shall have a chamfer of 30° (thirty degrees) from the faces and the interior diameter of the chamfer circle shall not be appreciably less than the width across the flats. In order that British Standard Spanners may be used wherever possible the widths across the flats shall conform with the limiting dimensions given in Columns 5 and 6 of Tables I, II, and III.

Screw Threads.

5. The Whitworth *form* of thread shall be employed on all screw threads. The angle between the slopes, measured in the axial plane, shall be 55°, and the thread shall be rounded equally at crests and roots, leaving a depth of thread approximately equal to 0·64 times the pitch.

All Screw threads shall have the gauge or full diameters, as the case may be, and the number of threads per inch given in Tables I, II, and III.

The female screw in the Liner and in the Male Screw Piece shall be conical, being coned one-sixteenth of an inch ($\frac{1}{16}$ in.) measured on the diameter per inch of length, and shall be made in accordance with the requirements of Report No. 61, British Standard Specification for Copper Tubes and their Screw Threads (primarily for Domestic and Similar Work). For the position of the Gauge Diameter see Appendix II, page 23.

The male and female Coupling Screws of the Union shall screw together by hand without undue shake.

Material.

6. All Three-piece Unions comprised within the terms of this Specification shall be cast from an Alloy having the following composition :—

Metal.	Percentage by weight.		
	Not exceeding	Not less than	Composition desired
Copper	88·0 %	82·0 %	85·0 %
Tin	5·5 %	4·5 %	5·0 %
Zinc	9·0 %	7·0 %	8·0 %
Lead...	2·0 %	—	2·0 %

Analysis.

7. The Manufacturer, if required by the Purchaser, the Engineer* or the Inspector,† shall supply, free of charge, an analysis of the Alloy used. A separate analysis may be required for every 1,000 lbs. of Unions cast.

Mechanical Tests.

8. If the Engineer, the Purchaser or the Inspector desire Tensile Tests made in accordance with Clauses 9 and 10, the Manufacturer shall, at the Purchaser's cost, furnish and prepare the test pieces and carry out the test, such cost being the actual net cost to the Manufacturer, but in the event of any of the Unions of any consignment failing under the Hydraulic Test specified in Clause 12, the Engineer, the Purchaser or the Inspector may require one tensile test for every 1,000 lbs. of Unions cast, or if less than 1,000 lbs. is cast then one tensile test for such less number of pounds, and in this event the cost of supplying and preparing the test pieces and making the test shall be borne by the Manufacturer.

Tensile Test Pieces.

9. The test bars shall be cast direct from the melting pot in dry sand. They shall be cast vertically in lengths of not less than 9 ins. and shall have a diameter of not less than $1\frac{1}{8}$ ins. They shall, before testing, be machined down to the dimensions of the British Standard Test Piece **E**. (See Appendix III, page 27.)

The test bars shall not be annealed, hammered, or otherwise treated.

Tensile Test.

10. The tensile breaking strength shall be not less than 12·5 tons per square inch and the elongation measured on the Standard gauge length shall be not less than 15 per cent. The Test shall be conducted cold.

Should a tensile test piece break outside the middle half of its gauge length, the test may, at the Manufacturer's option, be discarded, and another test be made.

Additional Tensile Test before Rejection.

11. Should any of the test pieces first selected by the Engineer, the Purchaser or the Inspector fail to comply with the requirements of Clause 10, a further tensile test may with the approval of the Engineer (or of the Purchaser) or the Inspector be taken, but should this test piece fail to fulfil the test the consignment of Unions made from the material from which the test piece was cast may be rejected.

---

* The word "Engineer" shall include any Engineer or Architect supervising or acting as Engineer or Architect in connection with the supply of the Unions or the works for which the Unions are required, or for the Purchaser.

† The word "Inspector" shall include any person acting under the express written authority of the Engineer (or of the Purchaser).

Hydraulic Test.

12. Every Union shall be tested by the Manufacturer before it leaves the works by subjecting it to an internal hydraulic pressure of not less than 300 lbs. per square inch. This pressure shall be maintained for a period of not less than 2 minutes without the Union showing signs of leakage.

The Engineer, the Purchaser and the Inspector shall have the right to be present at the application of this test.

Gauging.

13. The internal thread of the Union Ends (Liner and Male Screw Piece) shall be tapped in such a manner as to allow a male screw gauge of correct taper and gauge diameter to be screwed by hand into the thread for a distance of not less than 0·675 **B** nor more than 0·825 **B,** where **B** is the length of the thread in the Union Ends (see Col. 4, Tables I. and II.).

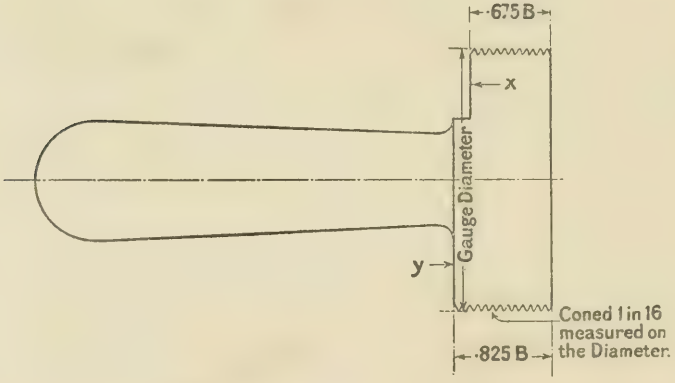


Fig. 1.

The gauge should be of the type shown in Figure 1 and have a sufficiently acute angle of thread to bear only on the roots of the thread in the Union Ends. When the gauge is screwed home by hand the surface **x** must pass inside the Union End, while the surface **y** must remain outside.

Inspection and Rejection.

14. The Engineer, the Purchaser and the Inspector shall at all reasonable times have free access to the works of the Manufacturer and to all places under his control and shall be at liberty to reject any Unions which do not comply with the tests and requirements of this Specification.

Testing Facilities and Place of Testing.

15. The Manufacturer shall at his own expense, except where otherwise provided in Clause 8, supply and prepare all test pieces and supply all labour and apparatus for testing which may be necessary or which may be required by the Engineer (or by the Purchaser) for carrying out the tests and requirements of this Specification at the Manufacturer's Works. If the Manufacturer shall fail to perform the foregoing obligations or any of them, the Engineer (or the Purchaser) shall be at liberty to perform the said obligations or any of them which the Manufacturer has failed to perform, either at the Manufacturer's Works or elsewhere and charge the cost and expenses thereof to the Manufacturer.

Arbitration.

16. In case any dispute shall arise between the parties to any contract in which this Specification is in whole or part incorporated as to whether any obligation, requirement, or test, referred to in this Specification, has been performed, carried out and/or complied with, then such dispute shall be referred to the arbitration of a person to be agreed upon between the parties, or failing agreement to be appointed, at the request of either party to the said dispute, by the Chairman for the time being of the Engineering Standards Committee, provided always that if such dispute is within the terms of any other agreement to refer or submit to arbitration this clause shall be of no effect.

BRITISH STANDARD COPPER-ALLOY THREE-PIECE UNIONS.

EXAMPLES OF ASSEMBLED UNIONS.

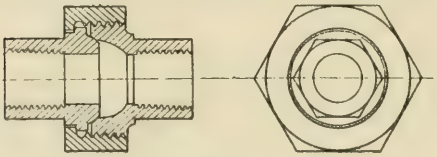


Fig 2.

Union Ends and Nut to be **Hexagonal** for nominal sizes up to and including ⅜ inch.

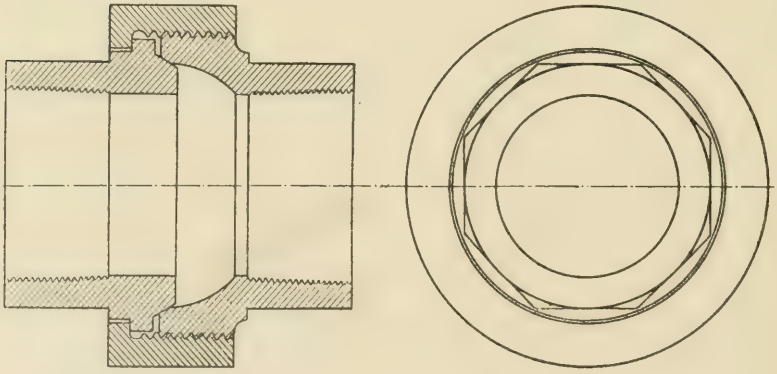


Fig. 3.

Union Ends and Nut to be **Octagonal** for nominal sizes ½ inch and above.

TABLES.

Table I. Liner.

Table II. Male Screw Piece.

Table III. Nut.

BRITISH STANDARD COPPER-ALLOY THREE-PIECE UNIONS.

LINER.

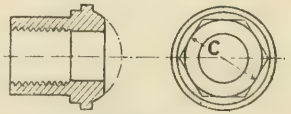


Fig. 4.

Union Ends to be **Hexagonal** for nominal sizes up to and including ⅜ inch, and to have a chamfer of 30° from the faces.

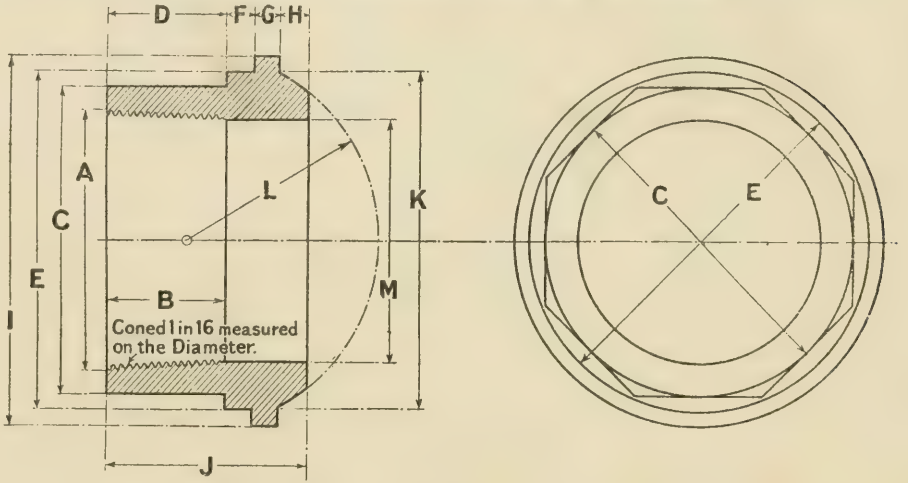


Fig. 5.

Union Ends to be **Octagonal** for nominal sizes ½ inch and above and to have a chamfer of 30° from the faces.

BRITISH STANDARD COPPER-ALLOY THREE-PIECE UNIONS.

TABLE I.—LINER.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Nominal Size of Union.	Gauge Diameter.	Number of Threads per inch in Union End.	Length of Thread in Union End.	Width across Flats. C		Corresponding British Standard Span. Size.	D	E	F	G	H	I	Total Length of Liner.	K	L	Internal Diameter.	Form of Union End.	Nominal Size of Union.
	A		B	Max.	Min.			Max.					J			M		
ins.	ins.		ins.	ins.	ins.		ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.		ins.
1/8	·248	28	·3125	·406	·401	—	·3125	·474	·078	·0785	·109	·584	·578	·484	·266	·183	Hexagon	1/8
1/4	·389	20	·375	·525	·520	1/4	·375	·611	·078	·078	·125	·729	·656	·641	·344	·302	Do.	1/4
3/8	·514	20	·500	·656	·651	—	·500	·763	·094	·094	·125	·876	·813	·750	·391	·419	Do.	3/8
1/2	·639	20	·500	·820	·815	7/16	·500	·893	·094	·093	·141	1·019	·828	·891	·500	·544	Octagon	1/2
5/8	·764	20	·625	1·010	1·002	9/16	·625	1·098	·109	·109	·141	1·273	·984	1·109	·625	·661	Do.	5/8
3/4	·889	20	·625	1·100	1·092	5/8	·625	1·195	·125	·125	·141	1·444	1·016	1·234	·750	·786	Do.	3/4
7/8	1·014	20	·750	1·300	1·292	3/4	·750	1·413	·141	·141	·156	1·623	1·188	1·438	·797	·903	Do.	7/8
1	1·155	20	·750	1·480	1·472	7/8	·750	1·608	·156	·156	·172	1·899	1·234	1·609	·938	1·044	Do.	1
1 1/4	1·405	20	·875	1·750	1·742	—	·875	1·900	·172	·171	·188	2·225	1·406	1·938	1·063	1·286	Do.	1 1/4
1 1/2	1·655	20	·875	2·050	2·040	1 1/4	·875	2·225	·188	·187	·219	2·465	1·469	2·234	1·234	1·536	Do.	1 1/2
1 3/4	1·929	16	1·000	2·410	2·400	1 1/2	1·000	2·616	·188	·187	·219	2·837	1·594	2·609	1·516	1·787	Do.	1 3/4
2	2·179	16	1·000	2·580	2·570	1 5/8	1·000	2·800	·219	·219	·250	3·087	1·688	2·813	1·578	2·037	Do.	2
2 1/4	2·429	16	1·000	3·020	3·010	1 7/8	1·000	3·276	·234	·235	·250	3·577	1·719	3·313	1·906	2·287	Do.	2 1/4
2 1/2	2·679	16	1·000	3·150	3·140	2	1·000	3·418	·234	·234	·266	3·826	1·734	3·422	2·000	2·537	Do.	2 1/2
2 3/4	2·929	16	1·000	3·550	3·535	2 1/4	1·000	3·851	·250	·250	·266	4·326	1·766	3·828	2·250	2·787	Do.	2 3/4
3	3·203	16	1·125	3·890	3·875	2 1/2	1·125	4·219	·250	·250	·281	4·576	1·906	4·234	2·500	3·053	Do.	3
3 1/4	3·453	16	1·125	4·180	4·165	2 3/4	1·125	4·533	·266	·266	·281	4·951	1·938	4·531	2·672	3·303	Do.	3 1/4
3 1/2	3·727	16	1·125	4·530	4·515	3	1·125	4·912	·266	·265	·313	5·326	1·969	4·938	2·938	3·577	Do.	3 1/2
3 3/4	3·977	16	1·125	4·690	4·670	3 1/8	1·125	5·085	·281	·282	·328	5·576	2·016	5·109	3·078	3·827	Do.	3 3/4
4	4·251	16	1·250	5·010	4·990	3 3/8	1·250	5·433	·281	·282	·328	5·824	2·141	5·422	3·328	4·093	Do.	4

No. 66–1914.

BRITISH STANDARD COPPER-ALLOY THREE-PIECE UNIONS.
MALE SCREW PIECE.

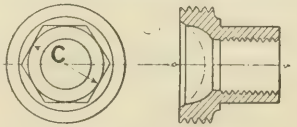


Fig. 6.

Union Ends to be **Hexagonal** for nominal sizes up to and including ⅜ inch, and to have a chamfer of 30° from the faces.

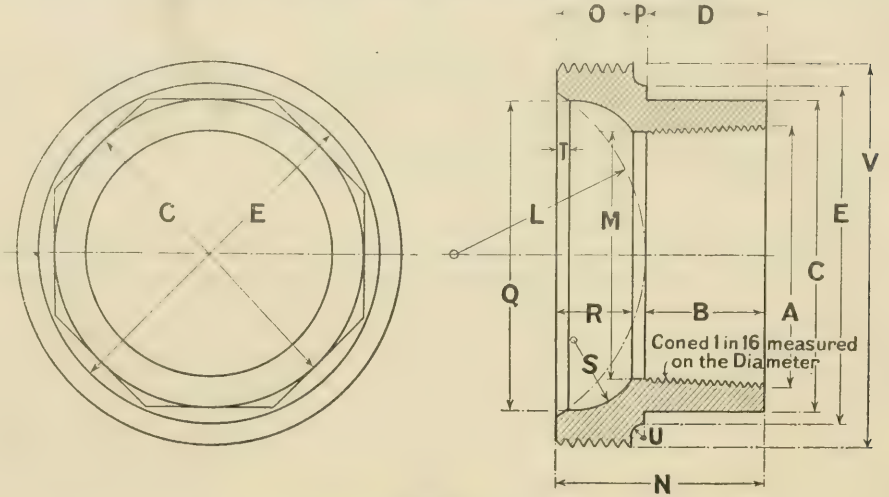


Fig. 7.

Union Ends to be **Octagonal** for nominal sizes ½ inch and above and to have a chamfer of 30° from the faces.

BRITISH STANDARD COPPER-ALLOY THREE-PIECE UNIONS.

TABLE II.—MALE SCREW PIECE.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Nominal Size of Union.	Gauge Diameter.	Number of Thrds. per inch in Union End.	Length of Thread in Union End.	Width across Flats. C		Corresponding British Spanner Size.	D	E	L	Internal Diameter.	Total Length of Male Screw Piece.	Lgth. of Coupling Thrd.	P	Q	R	S	Bearing Wth. of Seating.	U	Full Diameter of Coupling Thread.	Number of Thds. per inch.	Corresponding British Standard Pipe Thread.	Form of Union End.	Nominal Size of Union.
	A		B	max.	min.					M	N	O					T		V				
ins.	ins.		ins.	ins.	ins.		ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.				ins.
⅛	·248	28	·3125	·406	·401	—	·3125	·474	·266	·183	·609	·234	·0625	·391	·234	·156	·031	·063	·656	19	⅜	Hexagon	⅛
¼	·389	20	·375	·525	·520	¼	·375	·611	·344	·302	·672	·234	·063	·531	·234	·188	·047	·063	·825	14	½	Do.	¼
⅜	·514	20	·500	·656	·651	—	·500	·763	·391	·419	·828	·266	·062	·656	·266	·219	·047	·063	·972	14	—	Do.	⅜
½	·639	20	·500	·820	·815	⅞	·500	·893	·500	·544	·844	·281	·063	·750	·281	·250	·047	·063	1·115	14	—	Octagon	½
⅝	·764	20	·625	1·010	1·002	9/16	·625	1·098	·625	·661	1·047	·359	·063	·969	·359	·344	·047	·063	1·394	11	—	Do.	⅝
¾	·889	20	·625	1·100	1·092	⅝	·625	1·195	·750	·786	1·063	·375	·063	1·047	·375	·375	·047	·063	1·565	11	—	Do.	¾
⅞	1·014	20	·750	1·300	1·292	¾	·750	1·413	·797	·903	1·234	·422	·062	1·281	·422	·391	·063	·063	1·766	11	—	Do.	⅞
1	1·155	20	·750	1·480	1·472	⅞	·750	1·608	·938	1·044	1·234	·422	·062	1·422	·422	·391	·063	·063	2·000	11	—	Do.	1
1¼	1·405	20	·875	1·750	1·742	—	·875	1·900	1·063	1·286	1·500	·500	·125	1·781	·500	·500	·063	·125	2·347	11	2	Do.	1¼
1½	1·655	20	·875	2·050	2·040	1¼	·875	2·225	1·234	1·536	1·563	·563	·125	2·047	·563	·500	·078	·125	2·587	11	2¼	Do.	1½
1¾	1·929	16	1·000	2·410	2·400	1½	1·000	2·616	1·516	1·787	1·703	·578	·125	2·375	·578	·500	·078	·125	2·960	11	2½	Do.	1¾
2	2·179	16	1·000	2·580	2·570	1⅝	1·000	2·800	1·578	2·037	1·719	·594	·125	2·563	·594	·500	·109	·125	3·210	11	2¾	Do.	2
2¼	2·429	16	1·000	3·020	3·010	1⅞	1·000	3·276	1·906	2·287	1·719	·594	·125	3·031	·594	·500	·109	·125	3·700	11	3¼	Do.	2¼
2½	2·679	16	1·000	3·150	3·140	2	1·000	3·418	2·000	2·537	1·734	·609	·125	3·125	·609	·531	·109	·125	3·950	11	3½	Do.	2½
2¾	2·929	16	1·000	3·550	3·535	2¼	1·000	3·851	2·250	2·787	1·750	·625	·125	3·516	·625	·531	·109	·125	4·450	11	4	Do.	2¾
3	3·203	16	1·125	3·890	3·875	2½	1·125	4·219	2·500	3·053	1·906	·656	·125	3·875	·656	·531	·125	·125	4·700	11	—	Do.	3
3¼	3·453	16	1·125	4·180	4·165	2¾	1·125	4·533	2·672	3·303	1·969	·656	·188	4·188	·656	·531	·125	·188	5·075	11	—	Do.	3¼
3½	3·727	16	1·125	4·530	4·515	3	1·125	4·912	2·938	3·577	1·984	·672	·187	4·563	·672	·531	·141	·188	5·450	11	5	Do.	3½
3¾	3·977	16	1·125	4·690	4·670	3⅛	1·125	5·085	3·078	3·827	2·016	·703	·188	4·688	·703	·531	·156	·188	5·700	11	—	Do.	3¾
4	4·251	16	1·250	5·010	4·990	3⅜	1·250	5·433	3·328	4·093	2·188	·750	·188	4·969	·750	·594	·156	·188	5·950	11	5½	Do.	4

No. 66—1914.

BRITISH STANDARD COPPER-ALLOY THREE-PIECE UNIONS.

NUT.

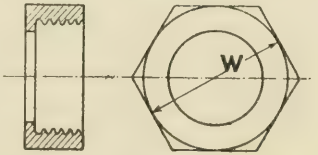


Fig 8.

Union Nuts to be **Hexagonal** for nominal sizes up to and including ⅜ inch, and to have a chamfer of 30° from the faces.

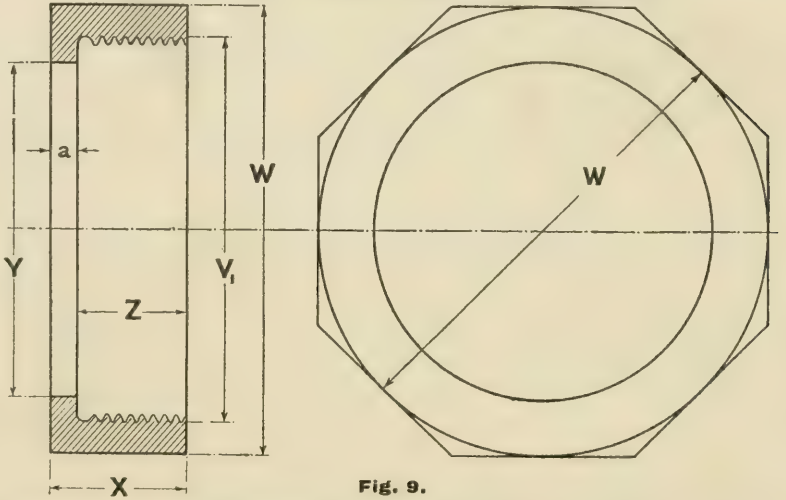


Fig. 9.

Union Nuts to be **Octagonal** for nominal sizes ½ inch and above, and to have a chamfer of 30° from the faces.

BRITISH STANDARD COPPER-ALLOY THREE-PIECE UNIONS.

TABLE III.—NUT.

1	2	3	4	5	6	7	8	9	10	11	12	13
Nominal Size of Union.	Full Diameter of Coupling Thread. V_1	Number of Threads per inch.	Corresponding British Standard Pipe Thread.	Width across Flats. W		Corresponding British Standard Spanner Size.	Length of Nut. X	Minimum Diameter of Hole. Y	Z	a	Form of Nut.	Nominal Size of Union.
				Max.	Min.							
ins.	ins.			ins.	ins.		ins.	ins.	ins.	ins.		ins.
1/8	·6568	19	3/8	·820	·815	7/16	·422	·479	·344	·078	Hexagon	1/8
1/4	·8259	14	1/2	1·010	1·002	9/16	·422	·616	·344	·078	Do.	1/4
3/8	·9730	14	—	1·200	1·192	11/16	·500	·768	·406	·094	Do.	3/8
1/2	1·1161	14	—	1·300	1·292	3/4	·516	·898	·422	·094	Octagon	1/2
5/8	1·3952	11	—	1·670	1·662	1	·625	1·103	·516	·109	Do.	5/8
3/4	1·5663	11	—	1·860	1·850	1 1/8	·688	1·200	·563	·125	Do.	3/4
7/8	1·7673	11	—	2·050	2·040	1 1/4	·766	1·419	·625	·141	Do.	7/8
1	2·0014	11	—	2·410	2·400	1 1/2	·797	1·614	·641	·156	Do.	1
1 1/4	2·3485	11	2	2·760	2·750	1 3/4	·922	1·906	·750	·172	Do.	1 1/4
1 1/2	2·5886	11	2 1/4	3·020	3·010	1 7/8	1·016	2·231	·828	·188	Do.	1 1/2
1 3/4	2·9617	11	2 1/2	3·550	3·535	2 1/4	1·047	2·623	·859	·188	Do.	1 3/4
2	3·2118	11	2 3/4	3·750	3·735	2 3/8	1·125	2·807	·906	·219	Do.	2
2 1/4	3·7019	11	3 1/4	4·180	4·165	2 3/4	1·156	3·283	·922	·234	Do.	2 1/4
2 1/2	3·9520	11	3 1/2	4·530	4·515	3	1·172	3·426	·938	·234	Do.	2 1/2
2 3/4	4·4521	11	4	5·010	4·990	3 3/8	1·234	3·859	·984	·250	Do.	2 3/4
3	4·7022	11	—	5·360	5·340	3 5/8	1·266	4·227	1·016	·250	Do.	3
3 1/4	5·0773	11	—	5·750	5·730	3 7/8	1·297	4·541	1·031	·266	Do.	3 1/4
3 1/2	5·4523	11	5	6·160	6·135	4 1/8	1·313	4·920	1·047	·266	Do.	3 1/2
3 3/4	5·7024	11	—	6·380	6·355	4 1/4	1·375	5·093	1·094	·281	Do.	3 3/4
4	5·9524	11	5 1/2	6·820	6·795	4 1/2	1·438	5·443	1·157	·281	Do.	4

APPENDICES.

Appendix I. Notes on Tables.

Appendix II. Definitions relating to Screw Threads.

Appendix III. Forms of British Standard Tensile Test Pieces.

APPENDIX I.

NOTES ON TABLES.

Tables I and II.—For the widths across the flats of the Liners and of the Male Screw Pieces (dimension **C**), British Standard sizes have been adopted except in the following sizes : $\frac{1}{8}$ in., $\frac{3}{8}$ in., $1\frac{1}{4}$ ins , where considerations of design have not rendered possible the adoption of a Standard size.

For the Female Screw Threads of the Liners and Male Screw Pieces, British Standard Screw Threads for Copper Tubes (Report No. 61, Tables I and II) have been adopted throughout.

Tables II and III.—For the Union Coupling Screws, British Standard Pipe Threads (Report No. 21) have been utilised both as to pitches and full diameters, with the exception of the following sizes, $\frac{3}{8}$ in., $\frac{1}{2}$ in., $\frac{5}{8}$ in., $\frac{3}{4}$ in., $\frac{7}{8}$ in., 1 in., 3 ins., $3\frac{1}{4}$ ins. and $3\frac{3}{4}$ ins. where other diameters have been found necessary.

Table III.—For the widths across the flats of the Nuts (dimension **W**), British Standard sizes have been adopted throughout.

APPENDIX II.

DEFINITIONS RELATING TO SCREW THREADS.

Gauge Diameter.—The Gauge Diameter of the female screw of the Liner or of the Male Screw Piece is the full diameter of the screw measured at right angles to the axis of the Union at the face of the Union End.

The following definitions of the elements of a Screw Thread, shown in Figures 10 and 11, have been approved by the Committee for general use.

FIG. 10.

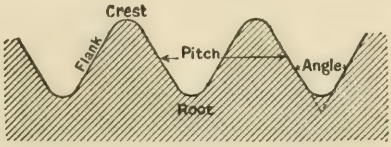


FIG. 11.

Effective Diameter of a Screw.—The Effective Diameter of a screw, having a single thread, is the length of a line drawn through the axis and at right angles to it, measured between the points where the line cuts the slopes of the thread. (Fig. 10.)

Core Diameter.—The Core Diameter is twice the minimum radius of a screw, measured at right angles to the axis. (Fig. 10.)

NOTE.—From Fig. 10 it will be seen that the "*core diameter*" of the male thread is measured between the roots of the thread; it should be borne in mind, however, that the "*core diameter*" of the female thread, being approximately the same dimension, is measured between the crests of the thread.

Full Diameter.—The Full Diameter is twice the maximum radius of a screw measured at right angles to the axis. (Fig. 10.)

Crest.—The Crest is the prominent part of the thread, whether of the male screw or of the female screw. (Fig. 11.)

Root.—The Root is the bottom of the groove of the thread, whether of the male screw or of the female screw. (Fig. 11.)

Slope of Thread.—The Slope of the Thread is the straight part of the thread which connects the crest and root. (Fig. 11.)

Angle of Thread.—The Angle of the Thread is the angle between the slopes, measured in the axial plane. (Fig. 11.)

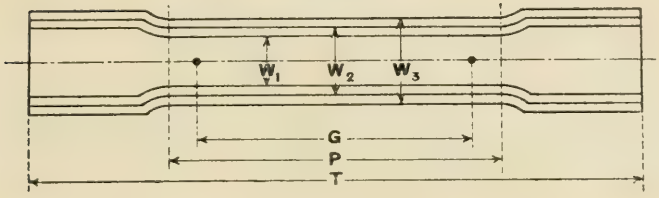
Pitch.—The Pitch is the distance in inches measured along a line parallel to the axis of the screw between the point where it cuts any thread of the screw and the point at which it next meets the corresponding part of the same thread. (Fig. 11.) The *reciprocal of the pitch* measures the number of turns per inch.

N.B.—The Committee recognise that it is the practice of the Tube Trade to make the thread on the conical ends of Pipes at right angles to the surface of the cone, in which case the pitch is the projection on to the axis of the Pipe of the distance between the points defined above measured along a line parallel to the surface of the cone.

APPENDIX III.

FORMS OF BRITISH STANDARD TENSILE TEST PIECES.

TEST PIECE **A.**

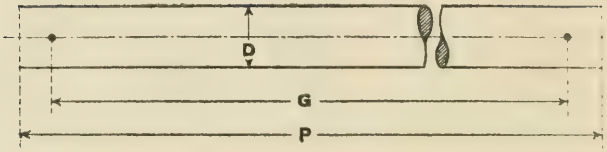


Gauge Length **G** = 8 inches.
Parallel Length **P** to be not less than 9 inches.
Total Length **T** = About 18 inches.

Thickness of Test Piece.	Maximum Width allowed.
Over $\frac{7}{8}$ in. (0·875 in.)	$W_1 = 1\frac{1}{2}$ ins.
$\frac{3}{8}$ in. (0·375 in.) to $\frac{7}{8}$ in. (0·875 in.)	$W_2 = 2$ ins.
Under $\frac{3}{8}$ in. (0·375 in.)	$W_3 = 2\frac{1}{2}$ ins.

The widths of the test pieces for plates were selected to comply with the two following conditions. (1) As the great bulk of plates to be tested are from $\frac{3}{8}$ inch to $\frac{7}{8}$ inch thick, it was desirable for the sake of convenience that the test pieces for such plates should be of uniform width, and, in accordance with very general practice, a width of 2 inches was selected. (2) With a test piece of a given form, the percentage of elongation was found to be less for thick plates than for thin ones; with steel of the same quality in other respects it was desirable therefore to choose widths of test piece which would be slightly in favour of the thicker plates. This is secured with the widths selected for the Standard Test piece of form **A.**

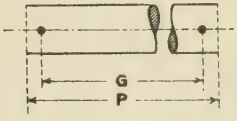
TEST PIECE **B.**



Gauge Length **G** to be not less than 8 times the diameter **D**.
With enlarged ends :—Parallel Length **P** to be not less than 9 times the reduced diameter **D**.

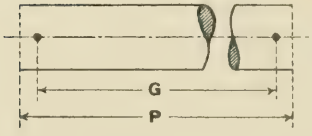
All test pieces of form **B** are strictly similar, and for the same material give the same percentage of elongation. They are nearly similar to a test piece of form **A**, 8 inches in gauge length, 2 inches wide and $\frac{3}{8}$ inch thick.

TEST PIECE **C.**



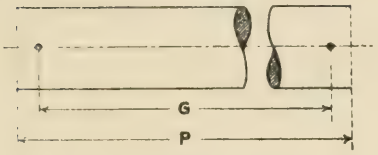
Gauge Length **G** = 2 inches.
Parallel Length **P** to be not less than $2\frac{1}{4}$ inches.
Dia. = 0·564 inch.
Area = $\frac{1}{4}$ sq. inch.

TEST PIECE **D.**



Gauge Length **G** = 3 inches.
Parallel Length **P** to be not less than $3\frac{3}{8}$ inches.
Dia. = 0·798 inch.
Area = $\frac{1}{2}$ sq. inch.

TEST PIECE **E.**

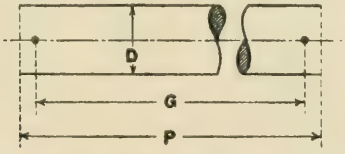


Gauge Length **G** = $3\frac{1}{2}$ inches.
Parallel Length **P** to be not less than 4 inches.
Dia. = 0·977 inch.
Area = $\frac{3}{4}$ sq. inch.

Test pieces **C, D,** and **E** were arranged to meet the very common practice of making test pieces for forgings, axles, tyres, etc., of either $\frac{1}{4}$ square inch or $\frac{1}{2}$ square inch in sectional area. With the gauge lengths decided upon these three forms are very nearly similar, and, for a given material, give very approximately the same percentage of elongation. Though not exactly, they are approximately similar to the Standard Test piece **F,** and for the same material give a nearly identical, but slightly greater, percentage of elongation.

TEST PIECE **F.**

(For Test Pieces over 1 inch diameter.)



Gauge Length **G** to be not less than 4 times the diameter **D.**
With enlarged ends:—Parallel Length **P** to be not less than $4\frac{1}{2}$ times the reduced diameter **D.**

In some testing machines it was found inconvenient to use form **B** for bars of over 1 inch in diameter, and form **F** of half the gauge length is designed to meet such cases. For a given material the percentage of elongation with test piece **F** is greater than with test piece **B,** and this difference is provided for in the British Standard Specifications.

FORM OF ENDS.

In the case of the round test pieces **B, C, D, E** and **F,** the form of the ends is to be as required in order to suit the various methods employed for gripping the test piece. When enlarged ends are used the length of the parallel portion of the test piece must in no case be less than that noted on the diagrams.

British Engineering Standards Association.

PRICE LIST

OF

BRITISH STANDARD SPECIFICATIONS AND REPORTS.

MAY, 1919.

(This List cancels all previous Lists.)

NOTE.—*A number of the Publications of the Association are being issued in French, Italian, Spanish and Portuguese. The majority of the English Editions and all the Foreign Translations (which also include the English text) are being published in octavo form, and will be available at* 1/- *net per copy or its equivalent in Foreign moneys.*

Report No.		Net.	Post free.
1-1914.	**Rolled Sections for Structural Purposes,** Lists of	1/-	1/2
2-1903.	**Tramway Rails and Fish-plates,** Specification and Sections of	1/-	1/3
3-1903.	**Influence of Gauge Length and Section of Test Bar on the Percentage of Elongation,** Report on, by Professor W. C. UNWIN, F.R.S.	1/-	1/2
6-1904.	**Rolled Sections for Structural Purposes,** Properties of ...	1/-	1/3
7-1910.	**Copper Conductors,** Tables of	1/-	1/2
8-1904.	**Tramway Poles,** Specification for Tubular	1/-	1/2
9-1909.	**Railway Rails,** Specification and Sections of Bull Head	1/-	1/3
10-1904.	**Pipe Flanges,** Tables of ...	1/-	1/2
11-1909.	**Railway Rails,** Specification and Sections of Flat Bottom ...	1/-	1/4
12-1915.	**Portland Cement,** Specification for...	1/-	1/2
13-1910.	**Steel for Shipbuilding,** Specification for Structural... ...	1/-	1/2
14-1907.	**Steel for Marine Boilers,** Specification for Structural	1/-	1/2
15-1912.	**Steel for Bridges,** etc., and General **Building Construction,** Specification for Structural	1/-	1/2
16-1905.	**Telegraph Material,** Specification for	1/-	1/3
18-1910.	**Tensile Test Pieces,** Forms of	Gratis	-/2
19-1905.	**Temperature Experiments on Field Coils** of Electrical Machines, Report on	1/-	1/3
21-1909.	**Pipe Threads** for Iron or Steel Pipes and Tubes, Report on ...	1/-	1/2
23-1905.	**Trolley Groove and Wire,** Standards for	1/-	1/2
24-1911.	**Railway Rolling Stock,** Specifications for **Material** used in the Construction of—		
	Part I. Locomotive, Carriage and Wagon Axles	1/-	1/2
	,, II. Locomotive, Carriage and Wagon Tyres	1/-	1/2
	,, III. Laminated, Volute and Helical Springs and Steel for Laminated Springs ...	1/-	1/2
	,, IV. Steel Forgings, Blooms and Castings	1/-	1/2
	,, V. Copper Plates, Rods and Tubes and Brass Tubes ...	1/-	1/2
	,, VI. Steel Plates, Angles, etc., and Rivets for Locomotives, Carriages and Wagons	1/-	1/2
27-1906.	**Limit Gauges for Running Fits,** Report on Standard Systems of	1/-	1/2
28-1908.	**Nuts, Bolt Heads and Spanners,** Report on	1/-	1/2
29-1909.	**Steel Forgings for Marine Purposes,** Specification for Ingot ...	1/-	1/2
30-1907.	**Steel Castings for Marine Purposes,** Specification for ...	1/-	1/2
31-1910.	**Steel Conduits for Electrical Wiring,** Specification for ...	1/-	1/2
32-1907.	**Steel Bars** for use in **Automatic Machines,** Specification for	1/-	1/2
35-1907.	**Copper Alloy Bars** for use in **Automatic Machines,** Specification for	1/-	1/2
37-1919.	**Electricity Meters,** Specification for	1/-	1/2
40-1908.	**Cast Iron Low Pressure Heating Pipes,** Specification for Spigot and Socket	1/-	1/2
41-1908.	**Cast Iron Flue or Smoke Pipes,** Specification for Spigot and Socket	1/-	1/2
42-1909.	**Steam Engines for Electrical Purposes,** Report on Reciprocating	1/-	1/2
43-1909.	**Boiler Tubes,** Specification for Charcoal **Iron** Lap-welded ...	1/-	1/2
44-1909.	**Cast Iron Pipes for Hydraulic Power,** Specification for ...	1/-	1/2
45-1917.	**Sparking Plugs** (for Internal Combustion Engines), Report on Dimensions for	1/-	1/2
46-1909.	**Keys and Keyways,** Specification for	1/-	1/2

LIST OF PUBLICATIONS—*continued.*

Report No.		Net.	Post free.
47-1914.	**Steel Fishplates** for Bull Head and Flat Bottom Railway Rails, Specification and Sections of ...	1/-	1/3
48-1909.	**Wrought Iron** of Smithing Quality for Shipbuilding (Grade D), Specification for	1/-	1/2
49-1909.	**Ammeters and Voltmeters,** Specification for	1/-	1/2
50-1910.	**Locomotives for Indian Railways,** Third Report on (Superseding Nos. 5 and 26)	Under Revision.	
51-1913.	**Wrought Iron** for use in Railway Rolling Stock ("Best-Yorkshire" and Grades A, B and C), Specification for	1/-	1/2
53-1913.	**Boiler Tubes** for Locomotive Boilers, Specification for Cold Drawn Weldless **Steel**...	1/-	1/2
54-1911.	**Screw Threads, Nuts and Bolt Heads** for use in **Automobile** Construction, Report on	1/-	1/2
55-1911.	**Copper and Bronze Wire,** Report on Hard Drawn	1/-	1/3
56-1911.	**Yield Point** and **Elastic Limit,** Definitions of	Gratis.	-/2
57-1911.	**Small Screws,** Report on Heads for	1/-	1/2
58-1912.	**Cast Iron Soil Pipes,** Specification for Spigot and Socket ...	1/-	1/2
59-1912.	**Cast Iron Waste and Ventilating Pipes** (for other than Soil Purposes), Specification for Spigot and Socket	1/-	1/2
61-1913.	**Copper Tubes** and their **Screw Threads** (primarily for domestic and similar work), Specification for	1/-	1/2
62-1913.	**Marine Boiler Stays, Screwing** for	Gratis.	-/2
63-1913.	**Broken Stone and Chippings,** Specification for Sizes of ...	1/-	1/2
64-1913.	**Fishbolts and Nuts** for Railway Rails, Specification for ...	1/-	1/2
65-1914.	**Salt-Glazed Ware Pipes,** Specification for...	1/-	1/2
66-1914.	**Copper-Alloy Three-Piece Unions** (for Low and Medium Pressure Screwed Copper Tubes), Specification for	1/-	1/2
67-1914.	**Ceiling Roses,** Specification for Two- and Three-Plate	1/-	1/2
68-1914.	**Steel Conductor Rails,** Method of Specifying the **Resistance** of	1/-	1/2
69-1915.	**Tungsten Filament Glow Lamps** (Vacuum Type) for **Automobiles,** Report on	1/-	1/2
70-1915.	**Pneumatic Tyre Rims** for Automobiles, Motor Cycles and Cycles, Report on	1/-	1/2
71-1917.	**Wheel Rims and Tyre Bands for Solid Rubber Tyres for Automobiles,** Report on Dimensions of	1/-	1/2
72-1917.	**Electrical Machinery,** British Standardisation Rules for ...	1/-	1/2
73-1915.	**Wall Plugs and Sockets,** Specification for...	1/-	1/2
74-1917.	**Charging Plug and Socket,** for Vehicles Propelled by Electric Secondary Batteries, Specification for	1/-	1/2
75-1916.	**Steels for Automobiles,** Specification for **Wrought**	1/-	1/2
76-1916.	**Tars, Pitches, Bitumens** and **Asphalts** when used for Road Purposes, Report on **Nomenclature** of and Specifications for **Tar** and **Pitch** for Road Purposes	1/-	1/2
77-1916.	**Electrical Pressures** for **New Systems** and **Installations** (Low and Medium Pressures) ...	Gratis	-/2
78-1917.	**Cast Iron Pipes** and Special Castings for **Water, Gas** and **Sewage,** Specification for	1/-	1/2
80-1917.	**Magnetos for Automobile Purposes,** Report on Dimensions of	1/-	1/2
82-1919.	**Starters for Electric Motors** (Face Plate Type), Specification for	1/-	1/2
83-April, 1918.	**Dope** and **Protective Covering** for **Aircraft,** Standard of Reference for	1/-	1/2
84-1918.	**Screw Threads (British Standard Fine), B.S.F.,** and their **Tolerances,** Report on	1/-	1/2
85-April, 1918.	**Steel** for **Aircraft** for **Government Purchases** in the **United States of America,** Specifications for	Under Revision	
86-1919.	**Magnetos for Aircraft Purposes,** Report on Dimensions of	1/-	1/2
87-1919.	**Airscrew Hubs,** Report on Dimensions for	1/-	1/2
88-1919.	**Electric Cut-Outs** (Low Pressure, Type O), Specification for	1/-	1/2

INTERIM REPORTS.

C.L. 2582.	**Ball Journal Bearings for Automobiles,** Interim Report on Sizes of Single Row...	Gratis	-/2
C.L. 3750.	**French Metric Screw Threads** for **Aircraft** Purposes, Interim Report on	-/6	-/8
C.L. 7130.	**Annealed Copper Conductors,** British Standards for ...	Gratis	-/2

Printed by
Waterlow & Sons Limited, 49, Parliament Street,
Westminster, S.W.1.